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985

Anritsu

OPERATION MANUAL

VHF TO MICROWAVE BAND POWER SENSORS

MA72A/B, MA73A

QUASI-MILLIMETER AND MILLIMETER WAVE BAND POWER SENSORS

MP712A/713A/714A/715A/716A/717A

MP737A/738A

MP81B/82B

800-255-7237

1987.09 x 70 NII-2(Y)
Printed in Japan

CERTIFICATION

ANRITSU CORPORATION certifies that this instrument has been thoroughly tested and inspected, and found to meet published specifications prior to shipping.
Anritsu further certifies that its calibration measurements are based on the Japanese Electrotechnical Laboratory and Radio Research Laboratory standards.

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N O T E

Quasi-millimeter wave and Millimeter wave band Sensors with special order flange are suffixed like MP712A4, MP713A4, MP715A1, MP715A4, MP81B4, etc.
All specifications of these Sensors are same as those of standard model Sensors.

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SECTION 1

GENERAL

The MA72A/B, MA73A, and MP [ ] Sensors are used with the ML83A Power Meter. The ML83A with these sensors measures power in the microwave to millimeter wave bands with high accuracy and displays the measured values digitally.

The power range which can be measured depends on the sensor used:

- o MA73A Sensor: -60 to -20 dBm (1 nW to 10 μW: 10 MHz to 18 GHz)
- o Other sensors: -20 to +20 dBm (10 μW to 100 mW)

Since any sensor can be combined with the ML83A Power Meter, they can measure a wide range of frequencies (10 MHz to 140 GHz).

These sensors have important features as shown below.

- o Wind band

  The sensors cover frequencies from 10 MHz to 140 GHz by combining with the ML83A.

- o Wide range of power measurement

  The -60 to +20 dBm power can be measured in frequency range from 10 MHz to 18 GHz by combining the MA72A/B or MA73A Sensor with the ML83A.

- o Excellent interchangeability

  Any sensor can be connected to the ML83A without adjustment. The sensor can be selected to suit the purpose.

- o Small dimensions and light weight

  Convenient shape and light weight for good portability.

SECTION 2

CONFIGURATION AND SPECIFICATIONS

2.1 Configuration

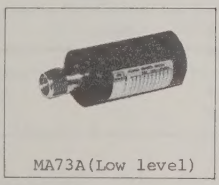
Table 2-1 and Figure 2-1 show the standard configuration of the MA72A/B, MA73A, and MP □ sensors.

Table 2-1 Standard Configuration of MA72A/B, MA73A, and MP □ Sensor

No.	Name	Q'ty
	Sensor	
1	MA □ or MP □	1 unit
2	Operation manual	1

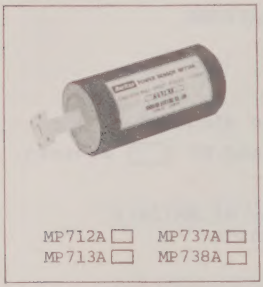
Coaxial type sensors

MA72A/B(High level)

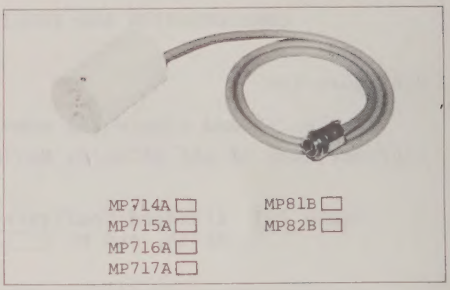


MA73A(Low level)

Waveguide type sensor



MP712A□ MP737A□
MP713A□ MP738A□



MP714A□ MP81B□
MP715A□ MP82B□
MP716A□
MP717A□

Fig. 2-1 Standard Configuration of Sensors

2.2 Optional Accessories

Sensor connecting cord

Item	Parts cord	Remarks
Sensor connecting cord: for MA□ , MA712A/ 713A/737A/738A□		

Fixed attenuators for high and medium power measurements

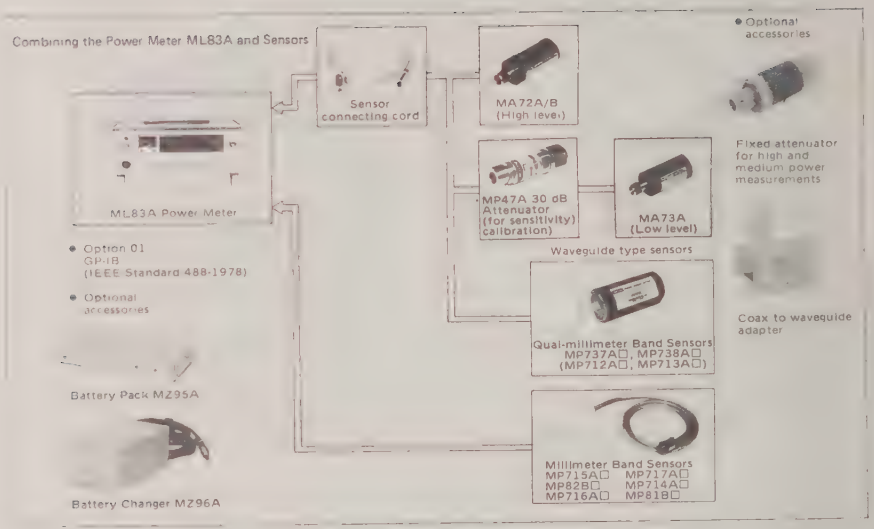
Item	Parts cord	Remarks
Attenuator MP721D (20 dB)		Type N, max 2W (+33 dBm), DC to 12.4 GHz; MP721□ (3,6, 10,20,30,40,50,60 dB)
20 dB attenuator	J0077	Type N, max 2W (+33 dBm), DC to 18 GHz
30 dB high power attenuator	J0063	Type N, max 10W (+40 dBm), DC to 12.4 GHz
20 dB high power attenuator	J0078	Type N, max 10W (+40 dBm), DC to 18 GHz
30 dB high power attenuator	J0079	Type N, max 25W (+44 dBm), DC to 8 GHz
30 dB attenuator MP47A		For sensitivity calibration

Coax to waveguide adapters

Item	Parts cord	Remarks
7 GHz coax to waveguide adapter	J0064	5.8 to 8.2 GHz, Type N(J), Waveguide WRJ-7, Flange BRJ-7
10 GHz coax to waveguide adapter	J0084	8.2 to 12.4 GHz, Type N(J), Waveguide WRJ-10, Flange BRJ-10

ML83A optional accessories

Item	Remarks
Battery peak MZ95A Battery charger MZ96A	Rechargeable, Run for about four hours.


Combining the Power Meter ML83A and Sensors
Sensor connecting cord
MA72A/B (High level)
• Optional accessories
Fixed attenuator for high and medium power measurements
ML83A Power Meter
MP47A 30 dB Attenuator (for sensitivity calibration)
MA73A (Low level)
• Option 01 GP-IB (IEEE Standard 488-1978)
• Optional accessories
Waveguide type sensors
Coax to waveguide adapter
Quasi-millimeter Band Sensors MP737A□, MP738A□ (MP712A□, MP713A□)
Battery Pack MZ95A
Millimeter Band Sensors MP715A□ MP717A□ MP82B□ MP714A□ MP716A□ MP818□
Battery Changer MZ96A

2.3 Specifications

Table 2-2, Table 2-3, and Table 2-4 show the specifications of each sensor.

Table 2-2 Specifications of MA72A/B and MA73A Sensors

Item	MA72A	MA72B	MA73A
Frequency range	10MHz to 14GHz	10MHz to 18GHz	
Impedance	50Ω		
Max. VSWR	1.4	10MHz to 14GHz 1.4 14 to 18GHz 1.5	10 to 50MHz 1.6 50MHz to 14GHZ 1.4 14 to 18GHz 1.6
Measuring power range	-20 to +20dBm (10μW to 100mW)		-60 to -20dBm (1nW to 10μW)
Safety power *1	+22dBm (160mW)		+23dBm (200mW)
Calibration accuracy	10MHz to 12.4GHz: 0.15dB (3.5%) 12.4 to 14.0GHz: 0.23dB (5.5%)	10MHz to 12.4GHz 0.15dB (3.5%) 12.4 to 14.0GHz: 0.23dB (5.5%) 14.0 to 18.0GHz; 0.3dB (7.0%)	10MHz to 50MHz: 0.27dB (6.5%) 50MHz to 12.4GHz: 0.19dB (4.5%) 12.4 to 14.0GHz: 0.29dB (7.0%) 14.0 to 18.0GHz: 0.33dB (8.0%)
RF input connector	N(P)		
Dimensions (mm)	43H, 53W, 88D		
Weight	≦ 300g		

Table 2-3 Specifications of MP737A/738A/712A/713A/714A □ Sensors

Item	MP737A□	MP738A□	MP712A□	MP713A□	MP714A□
Frequency range	17 to 22GHz	21.7 to 33GHz	18 to 26.5GHz	26.5 to 40GHz	33 to 50GHz
Flange	Refer to Flange Types (Table 2-5)				
Max. VSWR	1.6	1.5	1.6	1.5	
Measuring power range	-20 to +20dBm (10μW to 100mW)				
Safety power *1	+22dBm (160mW)				
Calibration frequency (GHz)	17,18,19, 20,21,22	21.7, 23,25, 27,29, 31,33	18,20,22, 24,26.5	26.5,28, 30,34,36, 38,40	33,40,50
Dimensions (mm)	ø51 x 103L				ø52 x 78L
Weight	≦ 450g				≦ 700 g *2

*1 Tested with equivalent ac power.

*2 Includes 1m cord attached on each sensor.

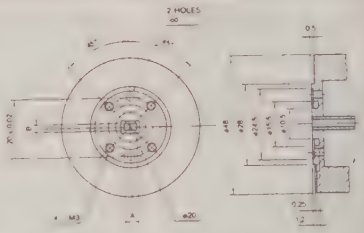
Table 2-4 Specifications of MP715A/716A/ 717A/81B/82B□

Model	MP715A□	MP716A□	MP717A□	MP81B□	MP82B□
Frequency range	4 to 60 GHz	50 to 75 GHz	60 to 90 GHz	75 to 110 GHz	90 to 140 GHz
Flange	Refer to Flange Types (Table 2-5)				
Max. VSWR	1.4	1.4	1.4	1.5	1.5
Measuring power range	-20 to +20 dBm (10 μW to 100 mW)				
Safety power*	+23 dBm (200 mW)				
Calibration frequency	40,50, 60 GHz	50,60, 75 GHz	60,75, 90 GHz	75,90, 110 GHz	90,110, 140 GHz
Dimensions(mm)	50ø x 75L				
Weight	≦ 700 g (includes 1 m cord attached on each sensor)				

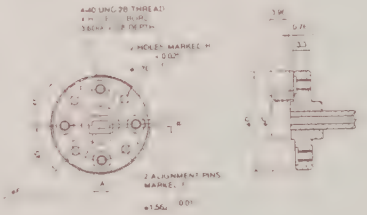
* Tested with equivalent ac power.

Tables 2-5 and Fig. 2-2 show the types and dimensions of flanges which can be used with the millimeter wave band sensor.

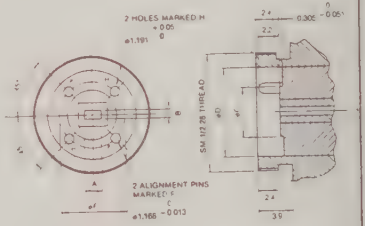
(a) Dimensions of flange used with MP737A, MP738A, MP712A, MP712A4, MP713A, MP713A4



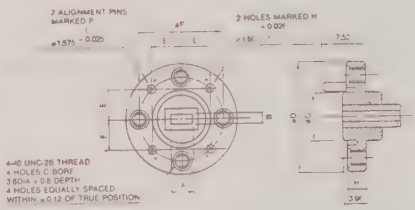
(b) Dimensions of flange used with MP714A, MP715A, MP716A, MP717A, MP81B, MP82B



(c) Dimensions of flange used with MP714A1, MP715A1, MP716A1, MP717A1, MP81B1



(d) Dimensions of flange used with MP82B1



(e) Dimensions of flange used with MP714A4, MP715A4, MP716A4, MP717A4, MP81B4, MP82B4

Fig. 2-2 Flange Dimensions

Table 2-5 Flange Types

Sensor Model	Type	Flange Dimensions A	B	C or ØC	D or ØD	E	F or ØF	H	Ød	See Fig.	Equivalent waveguide IEC	JAN	EIA
MP737A	FUBR-180	$12.954^{\pm0.026}$	$6.477^{\pm0.026}$	30.5	30.5	$10.285^{\pm0.025}$	$11.250^{\pm0.025}$	4.8	$4^{+0.10}_{+0.07}$		R-180	_	WR-51
MP712A	FUBR-220	$10.668^{\pm0.021}$	$4.318^{\pm0.021}$	22.4	22.4	$8.13^{\pm0.02}$	$8.51^{\pm0.02}$	4	$3^{+0.085}_{+0.060}$	Fig. 2-2 (a)	R-220	_	WR-42
MP738A	FUBR-260	$8.636^{\pm0.02}$	$4.318^{\pm0.02}$	21.1	21.1	$7.495^{\pm0.02}$	$7.875^{\pm0.02}$	4	$3^{+0.085}_{+0.060}$		R-260	_	WR-34
MP713A	FUBR-320	$7.112^{\pm0.02}$	$3.556^{\pm0.02}$	19.1	19.1	$6.35^{\pm0.02}$	$6.73^{\pm0.02}$	3	$3^{+0.085}_{+0.060}$		R-320	_	WR-28
MP714A	BRJ-40-MOD	$5.690^{\pm0.02}$	$2.845^{\pm0.02}$	_	_	_	_	_	$2.6^{+0.06}_{+0.02}$		R-400	_	WR-22
MP715A	BRJ-50-MOD	$4.775^{\pm0.02}$	$2.388^{\pm0.02}$	_	_	_	_	_	$2.6^{+0.06}_{+0.02}$		R-500	_	WR-19
MP716A	BRJ-60-MOD	$3.759^{\pm0.02}$	$1.880^{\pm0.02}$	_	_	_	_	_	$2.6^{+0.014}_{0}$	Fig. 2-2 (b)	R-620	RG-98/U	WR-15
MP717A	BRJ-75-MOD	$3.099^{\pm0.02}$	$1.549^{\pm0.02}$	_	_	_	_	_	$2.6^{+0.014}_{0}$		R-740	RG-99/U	WR-12
MP81B	BRJ-95	$2.540^{\pm0.02}$	$1.270^{\pm0.02}$	_	_	_	_	_	$2.6^{+0.014}_{0}$		R-900	_	WR-10
MP82B	BRJ-MOD	$2.032^{\pm0.01}$	$1.016^{\pm0.01}$	_	_	_	_	_	$2.6^{+0.014}_{0}$		R-1200	RG-138/U	WR-8
MP737A1	MIL-F-3922/ 70A-010	$12.954^{\pm0.026}$	$6.477^{\pm0.026}$	$33.32^{\pm0.38}$	$33.32^{\pm0.38}$	$12.14^{\pm0.017}$	$12.62^{\pm0.017}$	4.8	$3.66^{+0.07}_{0}$		R-180	_	WR-51
MP712A1	MIL-F-3922/ 54C-001	$10.668^{\pm0.021}$	$4.318^{\pm0.021}$	$22.22^{\pm0.3}$	$22.22^{\pm0.3}$	$8.13^{\pm0.017}$	$8.51^{\pm0.017}$	4.78	$2.95^{+0.05}_{0}$		R-220	_	WR-42
MP738A1	MIL-F-3992/ 63B-009	$8.636^{\pm0.02}$	$4.318^{\pm0.02}$	$22.23^{\pm0.13}$	$22.23^{\pm0.13}$	$8.13^{\pm0.035}$	$8.51^{\pm0.035}$	4.75	$2.95^{+0.05}_{0}$	Fig. 2-2 (a)	R-260	_	WR-34
MP713A1	MIL-F-3992/ 54C-003	$7.112^{\pm0.02}$	$3.556^{\pm0.02}$	$19.05^{\pm0.1}$	$19.05^{\pm0.1}$	$6.35^{\pm0.017}$	$6.73^{\pm0.017}$	4.75	$2.95^{+0.05}_{0}$		R-320	_	WR-28

Table 2-5 Flange Types (Cont.)

Sensor Model	Type	Flange Dimensions A	B	C or øC	D or øD	E	F or øF	H	ød	See Fig.	Equivalent waveguide IEC	JAN	EIA
MP714A1	MIL-F-3922/67B-006	$5.690^{\pm0.02}$	$2.845^{\pm0.02}$	$12.7^{\pm0.13}$	$28.58^{0}_{-0.05}$	_	23.81	_	_		R-400	_	WR-22
MP715A1	MIL-F-3922/67B-007	$4.775^{\pm0.02}$	$2.388^{\pm0.02}$	$12.70^{\pm0.13}$	$28.58^{0}_{-0.05}$	_	23.81	_	_	Fig. 2-2 (c)	R-500	_	WR-19
MP716A1	MIL-F-3922/67B-008	$3.759^{\pm0.02}$	$1.88^{\pm0.02}$	$9.53^{\pm0.13}$	$19.05^{0}_{-0.05}$	_	14.29	_	_		R-620	RG-98/U	WR-15
MP717A1	MIL-F-3922/67B-009	$3.099^{\pm0.02}$	$1.549^{\pm0.02}$	$9.53^{\pm0.13}$	$19.05^{0}_{-0.05}$	_	14.29	_	_		R-740	RG-99/U	WR-12
MP81B1	MIL-F-3922/67B-010	$2.540^{\pm0.02}$	$1.270^{\pm0.02}$	$9.53^{\pm0.13}$	$19.05^{0}_{-0.05}$	_	14.29	_	_		R-900	_	WR-10
MP82B1	MIL-F-3922 74-001-MOD	$2.032^{\pm0.010}$	$1.016^{\pm0.010}$	$5.334^{\pm0.051}$	$9.576^{\pm0.015}$	_	7.11	_	_	Fig. 2-2 (d)	R-1200	RG-138/U	WR-8
MP712A4	UG-595/U	$10.668^{\pm0.021}$	$4.318^{\pm0.021}$	$22.22^{\pm0.3}$	$22.22^{\pm0.3}$	$8.13^{\pm0.03}$	$8.51^{\pm0.03}$	$4.78^{\pm0.3}$	$2.95^{+0.05}_{0}$	Fig. 2-2 (a)	R-220	_	WR-42
M713A4	UG-599/U	$7.112^{\pm0.02}$	$3.556^{\pm0.02}$	$19.05^{\pm0.1}$	$19.05^{\pm0.1}$	$6.35^{\pm0.03}$	$6.73^{\pm0.03}$	$4.75^{\pm0.1}$	$2.95^{+0.05}_{0}$		R-320	_	WR-28
MP714A4	UG-383/U	$5.690^{\pm0.02}$	$2.845^{\pm0.02}$	$10.31^{\pm0.076}$	$28.58^{\pm0.076}$	$8.407^{\pm0.006}$	23.80	2.896	_		R-400	_	WR-22
MP715A4	UG-383/U -MOD	$4.775^{\pm0.020}$	$2.388^{\pm0.020}$	$10.31^{\pm0.076}$	$28.58^{\pm0.076}$	$8.407^{\pm0.006}$	23.80	2.896	_		R-500	_	WR-19
MP716A4	UG-385/U	$3.759^{\pm0.020}$	$1.880^{\pm0.020}$	$8.33^{\pm0.076}$	$19.05^{\pm0.076}$	$5.055^{\pm0.006}$	14.275	3.20	_		R-620	RG-98/U	WR-15
MP717A4	UG-387/U	$3.099^{\pm0.020}$	$1.549^{\pm0.020}$	$7.52^{\pm0.076}$	$19.05^{\pm0.076}$	$5.055^{\pm0.006}$	14.275	3.20	_		R-740	RG-99/U	WR-12
MP81B4	UG-387/U -MOD	$2.540^{\pm0.020}$	$1.270^{\pm0.020}$	$7.52^{\pm0.076}$	$19.05^{\pm0.076}$	$5.055^{\pm0.006}$	14.275	3.20	_	Fig. 2-2 (e)	R-900	_	WR-10
MP82B4	UG-387/U -MOD	$2.032^{\pm0.010}$	$1.016^{\pm0.010}$	$7.52^{\pm0.076}$	$19.05^{\pm0.076}$	$5.055^{\pm0.006}$	14.275	3.20	_		R-1200	RG-138/U	WR-8

NOTE:

Example of Typical Errors in Power Measurements.

The largest factor in power measurement errors is mismatching.

The coaxial sensors, the MA72A/B and the MA73A, have an excellent VSWR as shown in Fig. 2-3 so that errors due to mismatching are reduced. The errors when the VSWR(ρ) of the signal source is assumed to be 1.2 and 1.4 are shown in Fig. 2-4.

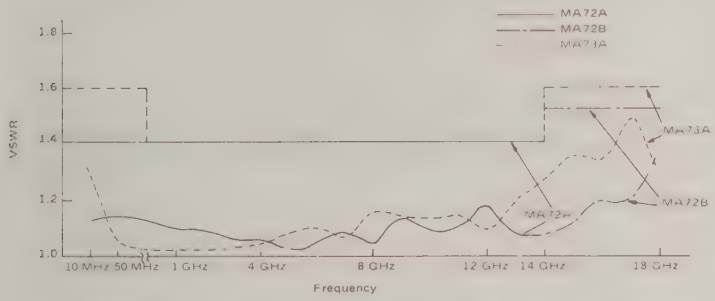


Fig. 2-3 MA72A/B and MA73A Sensors VSWR Characteristics

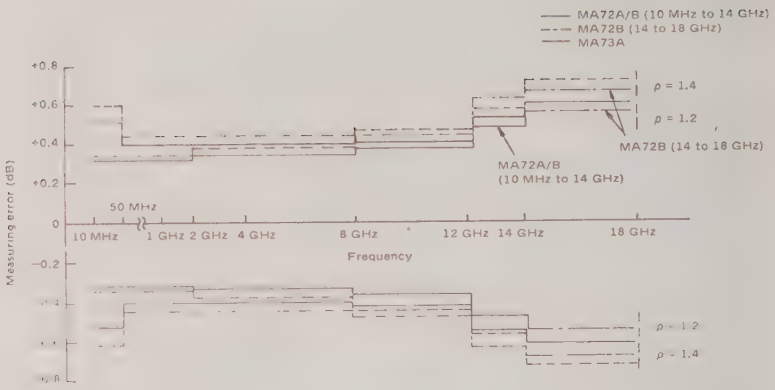


Fig. 2-4 Errors in power measurements (Typical example) Tested with the input level of 0 dBm (MA72A/B) and -40 dBm (MA73A) at normal temperature.

SECTION 3

OPERATION

3.1 Safety Measures

If an excessively high power is input to the sensor, the sensor or the power meter ML83A may be damaged.

A power higher than the maximum input power must not be applied directly to the sensor.

The maximum input power is as follows:

MA72A/B, MP712A/713A/714A/737A/738A
+22 dBm (160 mW)

MA73A, MP81B/82B/715A/716A/717A
+23 dBm (200 mW)

3.2 Operating and storage conditions

This sensor and power meter are designed to operate normally in an ambient temperature range of 0° to 50°C. For best operation, however, it should be used at normal room temperature whenever possible. Do not use or store the sensor and power meter in locations

1. where vibrations are severe.
2. where it is damp or dusty.
3. where there is exposure to direct sunlight.
4. where there is exposure to active gases.
5. where there is exposure to magnetism.
6. where oxidation or rusting may occur.

The sensor and power meter should be stored recommendedly in a temperature range of 0° to 30°C, and a humidity range of 40% to 80%. It should be cleaned before storage. The storage area should not be subject to large fluctuations in temperature over a 24-hour period.

If the sensor and power meter are operated at room temperature after being used or stored for a long period at low temperatures, condensation may occur and cause faulty measurement. To prevent this, do not turn the power on until the sensor and power meter are completely dry.

3.3 Sensor Operation

Since the sensor sensitivity is calibrated when it is shipped from the factory, RF power can be read directly by simply connecting the cord to the Power Meter ML83A.

3.3.1 Precautions

Take adequate case when operating this sensor.

(1) When connecting the waveguide type sensor with the system to be measured, tighten down the knock pin.

(2) If the ambient temperature changes sharply, offset voltage will be generated since the sensor (except MA73A) uses a thermocouple. Do not change the temperature of the thermocouple housing; for example, do not touch it during measurement.

It is especially important to select a location with minimal room temperature variation when using the high-sensitivity range of -20 to -10 dBm.

(3) Do not move the cover from the thermocouple housing because it has a moisture-proof seal (charged with inactive gas). If the element blows, please contact Anritsu or your nearest representative and return the entire thermocouple assembly.

3.3.2 Sensor Connection to ML83A power meter for measurement

The sensor must be connected with the following procedures:

STEP	PROCEDURE
1.	Connect a sensor to the sensor connecting cord. (The MP714A/715A/716A/717A/81B/82B □ sensor is already connected to the cord.)
2.	Connect the sensor connecting cord to SENSOR INPUT (13) of the ML83A.
	Note: Turn off the power to the ML83A before connecting the sensor; connecting a sensor to the ML83A while the power is on may damage the sensor.
3.	Connect the sensor to an RF signal to be measured.

3.3.3 Measurement

As to the details of measurement, refer to the operation manual of the ML83A.

SECTION 4

PRINCIPLES OF OPERATION

4.1 Block Diagram

Fig. 4-1 is a block diagram of the power meter ML83A with sensor.

4.2 MA72A/B, MP □ Sensor

4.2.1 Working Temperature of Thermocouple Junction

The MA72A/B and MP □ sensors use a thin-film thermocouple. The microwave or millimeter wave power applied to the sensor is converted by a resistor into heat. This heat is detected as a rise in temperature by the thermocouple and is converted into voltage.

The enclosed thermocouple is an alloy of bismuth and antimony. The thermal e,m.f. E of an antimony-bismuth thermocouple is as follows.

$$E = (117.6 - 0.0009tm)\ (t1-t2)\ \ (\mu V) \qquad (1)$$

where

t1 and t2: temperatures of both junctions

tm: average temperature of t1 and t2

However, since a thin-film type thermocouple is used in this instrument, E is only 70 to 80% of the e.m.f. shown in equation (1). Therefore, the approximate expression of the e.m.f. of this thermocouple is represented by equation (2).

$$E = 88\ (t1 - t2)\ (\mu V) \qquad (2)$$

The DC output voltage is approx. 600μV with an RF input of 10mW. Therefore, the temperature rise of the junction is approx. 7°C with the 10mW input of equation (2).

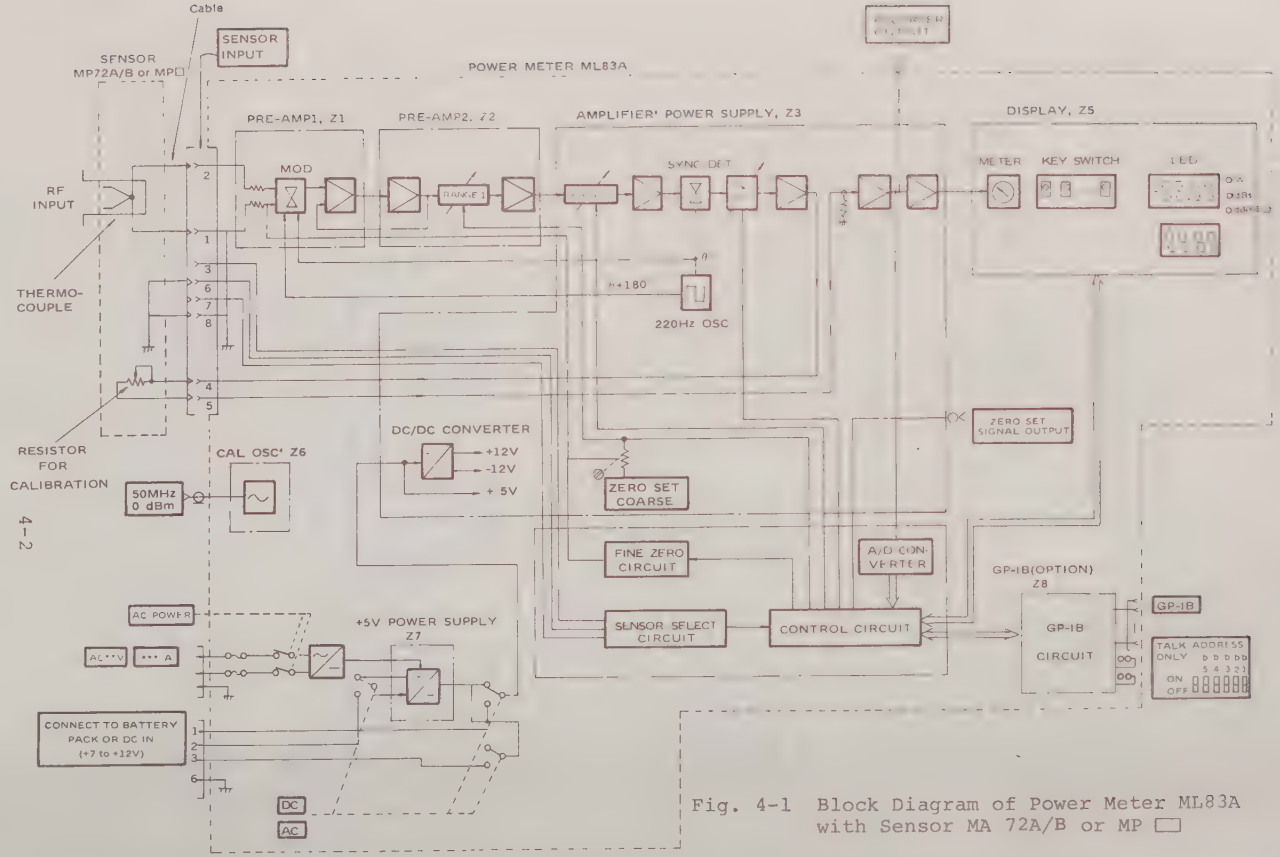


Fig. 4-1 Block Diagram of Power Meter ML83A with Sensor MA 72A/B or MP □

4.2.2 Linearity

It is assumed that (t1 - t2) is proportional to the input RF power in equation (1). Therefore, only the term containing tm effects the linearity. The coefficient of tm is unknown in the thin-film thermocouple, but the order of magnitude can be calculated from equation (1). According to this method, the deviation in linearity is approx. 4 x 10^{-5} with a 10mW input, making the tm term negligible in practice.

4.2.3 Influence of Fluctuation in Ambient Temperature

Since the coefficient of tm is unknown in the thin-film thermocouple as discussed in paragraph 4.2.2, the order of magnitude is calculated using equation (1). This gives a value of approx. 1 x 10^{-5} /°C. Actual measurements have yielded values of -(2 to 1.0) x 10^{-4} /°C.

4.2.4 Maximum Power

As can be seen from paragraph 4.2.1, the temperature of the junction increases to 70°C with an RF input of 100mW. Up to an approx. 300mW input at normal ambient temperature, there is no change of burn out, but there is a possibility that performance may vary due to high temperature; so avoid applying an excessive power input (more than 100mW) for a long period of time.

4.2.5 Moisture

The thermocouple has insufficient in damp-proofness. But since it is sealed, it operates normally at temperatures of up to 40°C and a relative humidity up to 90%.

4.3 MA73A Sensor

MA73A is an extremely sensitive sensor using a low-barrier schottky diode. This sensor can measure true power since this diode always operates within the square-law characteristic range.

The microwave applied to the sensor is detected by this diode, and a DC voltage proportional to the detected power is generated. This voltage is amplified and displayed on the power meter ML83A.

SECTION 5

CALIBRATION

5.1 Calibration of Millimeter Wave Band Sensor MP □

When the MP □ Sensor is used, the dc emf* resulting from the application of a low-frequency power is not always equal to the dc emf which results when the same power is applied at RF. Therefore, the instruments shown in Table 5-1 are required to calibrate the MP □ sensor.

*emf is electromotive force

Table 5-1 Instruments Required for Millimeter Wave Band Sensor Calibration

° Millimeter wave band signal generator (Maximum output power: 20 mW or higher)
° Cavity-resonator frequency meter
° Rotary-type variable attenuator (Attenuation 15 dB or more ; VSWR 1.15 or less)
° Standard power meter This is a power meter calibrated at 34 GHz by using a calorie meter which was calibrated at 34 GHz by the Electro-technical Laboratory of Japan. A taper waveguide having attenuation calibrated is provided with the meter.

The MP □ sensor can be calibrated with the following procedures:

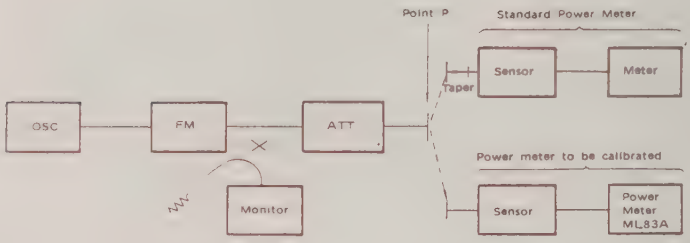


Fig. 5-1 MP □ Sensor Calibration Block Diagram

(1) Using the cavity-resonator frequency meter, set the oscillation frequency of the millimeter wave band signal generator to the reference frequency. For example, set it to the middle frequency of the frequency band used by the sensor.

(2) Using the standard power meter, measure the power at point P shown in Fig. 5-1, and set the attenuator so that the measured value is 1 mW (0 dBm).

(3) Disconnect the standard power meter from point P and connect the sensor of the power meter which is to be calibrated. Adjust and the CALIB in the sensor so that the power meter being calibrated indicates 1 mW.

Note: Adjustment of the CALIB in the sensor must be performed by removing an outer case.
The outer case, however, should not be removed unless calibration is to be performed.

(4) For other frequencies, apply the 1 mW power, which was calibrated with the standard power meter, to the power meter being calibrated. Then plot a calibration curve using the value indicated by the power meter being calibrated.

5.2 Operators Check

Perform the following checks when it has been located that any trouble should be in a sensor from the result of troubleshooting, or when a sensor has been accidently damaged by applying an excessive power of more than +22 dBm to its sensor.

Replace the defective sensor with a new one if the following check items cannot be satisfied.

(1) Resistor Check (See NOTE for pin numbers)

Model No.	Rin	Rout	
MA72A/B	50 ±3 Ω, *1 Input Connector	1.5 to 3 kΩ *2 ①, ② output connector	
MA73A	———	Forward *2: ② (+) ≦600 Ω ① (-)	Back *2: ② (-) ≧4kΩ ① (+)
MP □	———	190 to 230 Ω, ①, ② output connector	

*1 Multimeter Range 2 kΩ Range use.

*2 Tester Range x100 Ω Range use. (Load Current: ≦0.6 mA)

(2) Output Connector Check (See NOTE for pin numbers)

PIN. NO.	MA72A/B	MA73A	MP □	
1	Ground	Ground	Signal	
2	Signal	Signal	Signal	
3	Open	Ground	Open	
4	Gain Adj	Gain Adj	Gain Adj	Connecting variable resistor
5	Gain Adj	Gain Adj	Gain Adj	
6	Ground	Ground	Ground	
7	Open	Open	Open	
8	Ground	Ground	Ground	

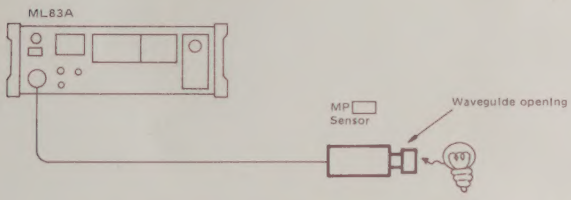
NOTE:

Nominal Sensitivity:

Model No.	Nominal Sensitiviity	Check point
MA72A/B	140 ±20 μV/m Watt, 50 MHz	① , ②
MA73A	≧410 μV/-30 dBm, 50 MHz	① , ②
MP □	≧50 μV/mW*	① , ②

Output connector

* In order to check if an MP □ sensor element is damaged, perform the following check:



① Connect the sensor as shown in the above figure.

② Approach the input terminal (waveguide opening) to a 60 to 100 W incandescent electric lamp.

③ It can be decided that the sensor is not probably damaged if the METER or DIGITAL DISPLAY of ML83A reads any measured value.

Repairing and calibrating sensor requires a special measuring system calibrated by the National Standard (e.g. National Bureau of Standard).

Therefore, it is recommended that the sensor be ordered to Anritsu for repair and calibration.

(As to the troubleshooting the power meter, refer to the service manual of ML83A.)

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